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PREDICTION OF GRADES AND SATISFACTION USING THE STRONG VOCATIONAL INTEREST BLANK

Thomas Alfred Welch

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THESIS

PREDICTION OF GRADES AND SATISFACTION USING THE STRONG VOCATIONAL INTEREST BLANK

by

Thomas Alfred Welch

June 1974

Thesis Advisor: R. S. Elster

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Research was undertaken to investigate improving selection criteria for several curricula at the Naval Postgraduate School using the Strong Vocational Interest Blank and a biographical questionnaire as indicators of academic success and satisfaction with curriculum and future assignments. The seven curricula investigated were merged into three groups for

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analysis, and useful predictors of academic success were found for each group. Further effort is required for the prediction of satisfaction.

Prediction of Grades and Satisfaction
Using the Strong Vocational Interest Blank

by

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Lieutenant Commander, United States Coast Guard
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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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I. INTRODUCTION

The research reported in this paper was carried out as part of a larger study at the Naval Postgraduate School (NPS) during 1973 and 1974. The goal of the NPS study was to develop methods for selecting U.S. Navy officers for graduate education who would do well academically and be satisfied with the material they studied and want to be assigned to jobs utilizing their education. This paper describes research conducted at NPS which used the Strong Vocational Interest Blank (SVIB) as a predictor of both academic grades and satisfaction with graduate education.

II. BACKGROUND

The U.S. Navy and the other U.S. services plus the armed forces of many allies spend millions of dollars every year on the graduate education of their officers. In recent times, about 570 Navy officers a year have received Navy funded graduate degrees at NPS. (Cong. Record, 1973, p. 617.) The justification for these expenditures for graduate education has been that certain Navy officer billets require the incumbent to have such an education in order to perform optimally in the job. As a matter of fact, the identification and description of such billets is used to determine how many officers are required with Masters degrees in any given area, e.g., physics or financial management. Given these derived minimum educational needs, the U.S. Navy's Bureau of Personnel (BuPers), selects officers for graduate education programs at NPS and civilian universities. The officers and BuPers expect, and hope, that all officer/students will successfully complete their program and attain their graduate degree. The officer probably also hopes that he will enjoy his studies; BuPers and the rest of the Navy should hope that the officer will desire to use his education in his later jobs, as that is how the officer's education will pay off in terms of the Navy's effectiveness. The best payoff to the Navy comes, then, when the officer does well in studies that he enjoys. The remainder of this investigation

focuses on research concerning the prediction of academic performance and satisfaction.

III. THE STRONG VOCATIONAL INTEREST BLANK

The Strong Vocational Interest Blank (SVIB) has been used in counseling and selection concerning civilian sector occupations for over 40 years in the United States. The SVIB was developed by contrasting responses to items (expressions of "Like," "Indifferent," or "Dislike" to items addressing activities, hobbies, reading materials, etc.) or people in an occupation with Men in General (MIG). The discriminating power of the responses to an item are expressed in terms of unit weights, e.g., L = 1, I = 0, D = -1, or, L = -1, I = 0, D = +1. The items differentiating between the occupation and the MIG group are then considered as forming a key for that occupation. An individual can then be scored using this key and his score compared with individuals in that occupation.

E. K. Strong, Jr. (Tyler, 1965, p. 193) put forth four propositions concerning the SVIB.

1. Men continuing in occupation A obtain a higher interest score in A than in any other occupation.

2. Men continuing in occupation A obtain a higher score in A than men entering other occupations.

3. Men continuing in A obtain higher scores in A than men who change from A to another occupation.

4. Men changing from A to B score higher in B prior to the change than in any other occupation including A.

Over the last forty years or so, these four propositions have been rather well corroborated (Tyler, 1965, p. 193).

The longitudinal stability of SVIB scores is also impressive. Over 22 year intervals, the correlations among individuals' occupational interest scores are around .80 and higher (Strong, 1951, p. 89-91). The stability of interest scores is influenced by two major factors (Tyler, 1965, p. 190),

1. Age when the SVIB was first taken.
2. The interval of time between the test and retest.

These two factors seem to be equally important in determining the similarity between test and retest SVIB occupational scores (Tyler, 1965, p. 189).

In U.S. Navy research using the SVIB, positive results have been obtained in predicting Naval Academy disenrollments (Abrahams and Neumann, 1973), NROTC disenrollments (Abrahams and Neumann, 1971), and in selecting NESEP men (Abrahams and Neumann, 1971), and Navy recruiters (Abrahams, Neumann and Rimlard, 1973 and Abrahams and Neumann, 1974).

Several recent studies of the use of the Strong Vocational Interest Blank (SVIB) in prediction of academic achievement offer evidence as to the effectiveness of this instrument for that purpose. Most of the studies relate to undergraduate academic achievement as measured by grade point average (GPA).

These studies can generally be divided into two classes, those using the non-vocational scales (primarily the Academic

Achievement scale) as predictors and those relating the vocational scales to scholastic performance.

Hauntras, Lee and Hebahlran present a step-wise regression, with grade point average as the dependent variable, using all of the occupational scales. The sample of 423 male freshmen were divided into the six Holland classes (Realistic, Intellectual, Artistic, Conventional, Social and Enterprising) using the Holland Vocational Interest Blank Scores. For the entire sample the Strong Academic Achievement (AACH) score was the best predictor (r = .374), as it was for the Realistic Orientation group (r = .365), the Intellectual Orientation group (r = .420) and the Artistic Orientation group (r = .303). All but the Artistic group coefficients were significant at the .01 level, which was significant at the .05 level. The Occupational Level scale was the best predictor for the Conventionally Oriented (N = 412), with AACH the second best predictor.

Johnson analyzed the SVIB results for 290 art/science and 98 business administration freshmen utilizing the Rust and Ryan achievement scales, the Martin AIS scales, the Self-rating Scale and the AACH scale. Johnson also calculated a Predicted Achievement Score based on a combination of high school rank and the Scholastic Aptitude Test score. These correlations are summarized on page 12.

Campbell and Johansson in the original validation studies for the Academic Achievement scale (AACH) report a correlation between men's AACH score and GPA of .52 for a group of

Scale/Test	Art/Science	Bus. Ad.	Both
Rust-Ryan	-.18	.01	.01
AIS - short	.12	.14	.06
AIS - long	.09	-.08	.08
Self-Rating	.00	.12	.05
HS rank & SAT score	.19*	.32*	.24*
AACH	.17**	.02	.18*

*p = .01

**p = .05

Minnesota freshmen, however for the freshmen cross validation group the coefficient dropped to .36. For another cross validation group made up of a twenty-five year follow-up sample, Campbell obtained a .35 correlation with grades. Using attained educational level for this latter sample an AACH mean score of 58 was found for PhD recipients, 52 for MA recipients, 47 for BA recipients, and 42 for those who obtained no degree. Almost a full standard deviation separated the PhD and the BA recipients. It is difficult to say, however, whether higher degrees reflect an AACH interest or if those with higher degrees develop a greater AACH interest. Increase in scores during the four college years suggest the latter explanation.

Lindsay and Althouse concluded that the AACH is not better than aptitude measures and past performance in predicting academic performance. For a sample of first-year

male students at Penn State the following correlations with grade point average were produced: AACH .10, SAT verbal .19, SAT math .09 and high school GPA .38. For women the coefficients were .25, .48, .15 and .29 respectively. In a multiple correlation analysis, when AACH was added to the SAT score and grade point average, multiple R was raised only from .5177 to .5289.

At Illinois, Wagman found a correlation between grades and AACH of .35 for 193 graduate and undergraduate students. By comparison, the correlation between the Student College Aptitude Test and the grades was .39.

In a study relating persistance to pursue an engineering curriculum to occupational interests, Taylor and Hanson divided engineering and former engineering students into four groups: (1) the academically successful who remained in the engineering program; (2) the successful students who transferred out of engineering; (3) unsuccessful students who dropped out, and, (4) unsuccessful students who stayed in engineering. Higher scores were achieved by successful engineers than successful transfers in the following occupational interests: Carpenter, Printer, Farmer, Math.-Science Teacher, and Veterinarian. The persistors had lower scores than the transfers for Personnel Director, Social Science Teacher, School Superintendent, Life Insurance Salesman, Advertising, Lawyer and Journalist. The academically inadequate who dropped out differ from the successful persistors in that they achieved higher scores for Mortician and Social

Science Teacher, and lower scores for Chemist and Psychologist. The transfers had higher scores than those in the other three classifications for Personnel Director, School Superintendent, Advertising, Lawyer, Journalist, Political Scientist, Sociologist and Occupational Level and lower in Farmer, Math.-Science Teacher, Veterinarian, Printer and the Mechanical score. The two groups of persistors scored higher than the withdrawers in Phychologist and Academic Achievement. Persistors made higher grades in Science than the non-persistors, and, regardless of their grades, those students with interest in solving math and science problems stayed in the engineering curriculum.

A 1969 study at NPS by Fernald, *et. al*, found high relationships between SVIB occupational scales and grade point averages using multiple regression methods. Unfortunately, they did not cross validate their equations, and, as they had used step-wise multiple regression procedures, it was impossible to estimate how much the obtained multiple correlations would shrink in a new sample (Thorndike, p. 205).

IV. PROCEDURE

During fiscal year 1974, officer/students in a number of curricula at NPS were administered the SVIB. The curricula and numbers of individuals sampled are given in Table I.

Table I.

Curricula and Numbers of Officer/Students in the SVIB Sample

Curriculum	Number of Officer/Students Taking SVIB
360 OpsRes./SysAnal.	80
367 CompSysMgt.	48
368 Comp. Science	24
610 AeroEng.	103
620 ComMgt.	42
816 SysAcqMgt.	52
817 Mgt.	130
	479

The officer/students in these curricula range from ensign to Commander in military rank and from about 22 to 40 in age. The Navy officers included in the sample were chaplains, pilots, surface ship officers, submariners, engineering duty officers, and supply officers.

Following the collection of the SVIB answer sheets, the forms were sent to the Navy Personnel Research and Development Center (NPRDC) in San Diego, California, where the individuals' responses were processed and scored. Each officer/student was scored in terms of the similarity between his responses to the SVIB and the responses of individuals

in each of 56 occupations.[1] An average score for each of the curricula was also computed on each of the SVIB's occupational scales. These averages are contained in Appendix A. A master magnetic tape was also developed at the NPRDC containing each individuals responses to each of the 399 items in the SVIB. (These item response data were used later in attempts to construct SVIB scales predictive of grade average and satisfaction.)

Because of the relatively small number of officer/students in each of the curricula, and because some of the intended data analyses would require samples larger than could be obtained from any single curriculum, an investigation was conducted to determine if the SVIB data from some curricula could be aggregated. In this analysis, correlations were computed among the curricula based upon their scores on the 56 occupational keys. Table II shows the correlations that were obtained.

The correlations in Table II indicate that all of the management curricula tended to have fairly similar SVIB profiles with one another, and that the SVIB occupational scores from the OR/SA curriculum tended to be more similar to those from the management curricula than to those from CS or Aero curricula. Further, the CS and Aero curricula SVIB scores tend to be more similar to one another than they

---

[1] For a further description and explanation, Campbell, D. P., Handbook for the Strong Vocational Interest Blank, Stanford University Press, 1971.

do to any of the other curricula. Based upon these correlations, the data from the management (#367, #620, #816, and #817) and OR/SA (#360) curricula were aggregated, while those from CS (#368) and Aero Eng. (#610) were placed together in another set.

Table II.

Intercorrelations Among SVIB Occupational Scores for Seven Curricula

		Curricula						
		1	2	3	4	5	6	7
CURRICULA	1	1.00	.87	.77	.93	.84	.77	.84
	2		1.00	.96	.88	.77	.64	.83
	3			1.00	.78	.67	.49	.76
	4				1.00	.91	.85	.91
	5					1.00	.90	.94
	6						1.00	.86
	7							1.00

1 = ComMgt.
2 = AeroEng.
3 = Comp. Science
4 = SysAcqMgt.
5 = CompSysMgt.
6 = Mgt.
7 = OR/SA

For data analysis purposes, developmental and cross validation groups were then formed. Table III displays the curricula and the numbers of officer/students in the various developmental and cross validation groups.

A. PRELIMINARY ANALYSES

As grades (TQPR's) and satisfaction were to be used as the criteria in this research, it was necessary to measure and

Table III.

Sizes of the Developmental and Crossvalidation Groups Used in the Analyses of SVIB Occupational Scores as Predictors of Academic Grades and Satisfaction

Management	Developmental	Crossvalidation	Total
817 Mgt.	73	20	93
620 ComMgt.	30	12	42
816 SAM	37	15	52
367 CSM	35	13	48
Total	175	60	235
CS/Aero			
368 CS	16	7	23
610 Aero	60	29	89
Total	76	36	112
OR/SA			
360 OR/SA	50	21	71
Grand Totals	301	117	418

understand these variables. This section describes how the criteria data were developed and processed prior to their use with the data from the SVIB.

1. Grades

Each of the officer/students in the sample (except for those in Aeronautical Engineering) reported his grade average in his graduate curriculum at NPS. This numerical average would fall on the following scale:

Grade	Numerical Value
A	4.0
B	3.0
C	2.0
D	1.0
Failing	0

The Aeronautical Engineering curriculum presented a unique problem, however, as officer/students in that curriculum had been graded on a different system. For the purposes of this study, grades from Aero were treated as follows:

Aero Grade System	NPS Grade Equivalent	Numerical Value
H	A	4
G	B	3
S	C	2

The grades for Aero Eng. students were computed by the author of this thesis based upon records available in the Aero Eng. curriculum office.

After each of the officer/students in the sample had reported or been assigned a TQPR, preliminary investigation of these data were launched. The first question to be answered concerned the validity of reported TQPR's.

The NPS academic transcripts of 55 Management students (Curriculum #817) were retrieved and the students' computed TQPR's compared with their self-reported TQPR's. The correlation between the reported and actual TQPR's was .99, and the means were 3.37 and 3.34, respectively. The NPS academic transcripts of all 42 U.S.N. students in Communications Management (Curriculum #620) were also obtained, and their actual TQPR's compared with their self-reported TQPR's. In all 42 cases, their actual and self-reported TQPR's were identical. It seemed obvious that self-reported TQPR's provided rather accurate estimates of actual TQPR's. Hence, most of the analyses reported in this study will utilize self-reported TQPR.

The second study of TQPR's investigated the longitudinal stability of individuals' TQPR's. This investigation was important for two major reasons. First, if grades are quite unstable over time, i.e., the ordering of students according to TQPR's changes from quarter to quarter, then different variables would likely be important in predicting TQPR's in different quarters of a curriculum. This would have introduced added complexities to this study, although the prediction of TQPR in the final quarter of the curriculum would still have been of paramount importance. (Though the researcher would have to remember that some officers may have been removed from the curriculum due to low grades in earlier quarters, and this may have been due to low abilities in areas, e.g., verbal, not required in the later quarters of the curriculum.)

The second reason for the importance of the grade stability study stemmed from the relatively small sample sizes in the different curricula. The set of students in a curriculum consisted of two or more subsets of students that had been in the curriculum different lengths of time. In Aero Eng., for example, there were student groups that had been in the curriculum 1, 3, 5, 7, or 9 quarters. If TQPR's were stable over time, then TQPR data from students who had finished only a few quarters could be considered as indicative of what their TQPR's (or at least their relative standing on TQPR when compared with their peers) would be after they had completed their curriculum. And if TQPR's after a few quarters

could be considered as indicative of later TQPR's, then the subsets of students who had been in the curriculum different amounts of time could be merged and used in later statistical analyses examining the SVIB as a predictor of TQPR.

The first analysis of TQPR stability was a longitudinal study of the stability of grades in the Operations Research/Systems Analysis, Management, and Aeronautical Engineering curricula.

An examination of students' records in the Operations Research/Systems Analysis curriculum office revealed that 25 U.S. Navy officers were currently enrolled in their seventh quarter of that curriculum. This is the same number of officers who had enrolled in the curriculum over six quarters previously. Hence, no U.S. Navy officers in that input to the OR/SA curriculum had been lost. Each of the 25 officers' TQPR's was computed at the end of each of the six quarters that had been completed. Intercorrelations among the six sets of TQPR's were then calculated. These correlations are shown in Table IV.

Table IV.

Correlations Among TQPRs After Completion of Different Numbers of Quarters of the OR/SA Curriculum (N = 25 U.S.N. Officers)

		Quarters Completed[1]					
		1	2	3	4	5	6
Quarters Completed[1]	1	1.00	.95	.92	.92	.90	.89
	2		1.00	.98	.97	.96	.95
	3			1.00	.99	.98	.97
	4				1.00	.99	.99
	5					1.00	1.00
	6						1.00

[1] Each quarter is 12 weeks in length.

As TQPR is a cumulative average, the correlations among TQPR's from different quarters are part-whole correlations. One would therefore expect fairly high intercorrelations among TQPR's from successive quarters, but the magnitudes of the correlations in Table IV are surprisingly high. Particularly surprising are the intercorrelations between TQPR after one quarter with the TQPR's after five (r = .90) or six quarters (r = .89). All in all, the data in Table IV indicate that TQPR's after two or three quarters in a curriculum are quite predictive of TQPR's after six quarters.

Students' grade records were also gathered from the Aeronautical Engineering and the Management curricular offices. A TQPR was computed for each student at the end of each of the quarters he had completed. The intercorrelations among these TQPR's are shown in Tables V and VI.

Table V.

Correlations Among TQPRs After Completion of Different Numbers of Quarters of the Aero Eng. Curriculum (N = 24 U.S.N. Officers)

		Quarters Completed[1]			
		1	2	3	7
Quarters Completed[1]	1	1.00	.94	.93	.87
	2		1.00	.98	.90
	3			1.00	.92
	7				1.00

[1] Each quarter is 12 weeks in length.

Table VI.

Correlations Among TQPRs After Completion of Different Numbers of Quarters of the Management (#817) Curriculum (N = 33 U.S.N. Officers)

		Quarters Completed[1]				
		1	2	3	4	5
Quarters Completed[1]	1	1.00	.87	.85	.83	.78
	2		1.00	.98	.96	.93
	3			1.00	.98	.94
	4				1.00	.97
	5					1.00

1. Each quarters is 12 weeks in length

The pattern of correlations in Tables V and VI is much like that displayed for the OR/SA curriculum in Table IV: After two or three quarters in his curriculum, an officer/students' TQPR after five or more quarters can be readily predicted. More specifically, an individual's standing in the distribution of TQPR's after five or more quarters can be predicted from his TQPR after two or three quarters. Because of the nature of the correlation coefficient, the high correlations among TQPR's shown in the previous tables do not mean that the average TQPR's in quarters one or two equalled the TQPR's in, say, quarters five, six, or seven (Guilford, 1965, p. 101). Therefore, an investigation was made to determine the pattern of average TQPR's over the successive quarters in a curriculum. The following tables display some TQPR averages from three NPS curricula.

Table VII shows the average TQPR's earned by two different inputs (January and July 1973) to the Management

Table VII.

Three Quarter Longitudinal Study of Management Students' Quarterly QPRs[1]

	Section		Quarter of Curriculum 1	2	3
Jan 1973 Input	1 (N=20)	Mean	3.38	3.38	3.45
		Std. Dev.	.27	.36	.27
	2 (N=23)	Mean	3.20	3.22	3.33
		Std. Dev.	.39	.39	.34
	3 (N=22)	Mean	3.36	3.40	3.44
		Std. Dev.	.27	.26	.23
	Overall Mean		3.30	3.33	3.40
July 1973 Input	1 (N=18)	Mean	3.32	3.35	3.38
		Std. Dev.	.39	.36	.34
	2 (N=16)	Mean	3.38	3.38	3.42
		Std. Dev.	.31	.35	.30
	3 (N=18)	Mean	3.32	3.32	3.35
		Std. Dev.	.38	.39	.35
	Overall Mean		3.34	3.34	3.38

[1] As the July 1973 input had only completed three quarters, comparisons could only be made for those three quarters. Data were from NPS records.

curriculum. Each of these two inputs was divided into three administrative sections. The student sections are formed in a stratified-random procedure, with military ranks defining the strata.

The data in Table VII show that the differences among the means of the three sections in the same input tend to be larger than the differences between the overall means of the two inputs. Further, each of the six sections received

higher QPR's in their third quarter than they did in their first quarter.

Rather than risk conclusions concerning issues such as "grade creep" based upon only the data in Table VII, analyses were made of the grade averages in several other curricula, as reported in Table VIII.

The reader should recall that the data in Table VIII are from a cross-sectional sampling. Because of this, one cannot know for sure whether or not the differences among the TQPR statistics in a curriculum are due to differences among the inputs into the curriculum and/or due to changes in the courses, standards, etc., within the curriculum. Given the differences among the TQPR's of the management sections shown in Table VII, the differences among the mean TQPR's for a given curriculum in Table VIII do not appear to be larger than might be expected to occur by chance. (The possible exception to this assertion is in the Computer Science curriculum, where two mean TQPR's differ by .22, but one of the means was computed from a sample of only three.) Based upon these considerations and the data shown in the preceding tables, the decision was made to standard score the TQPR's for each input into each curriculum. Through this process, the distribution of TQPR's for individuals in the same input to the same curriculum was converted to a mean of zero and a standard deviation of one. Thus, the standardization process yielded equal TQPR means and standard deviations for all of the inputs and curricula. For some of the

Table VIII.

Cross Sectional Study of Grade Averages (TQPR's) in Several NPS Curricula[1]

		I	II	III	IV	V	VI	VII	VIII	IX
OpsRes./SysAnal.	$\bar{X}$	-	3.30	-	3.43	-	3.33	-	-	-
(#360)	S	-	.37	-	.26	-	.33	-	-	-
	N	0	23	0	21	0	30	0	0	0
CompSysMgt.	$\bar{X}$	3.37	-	3.33	-	-	-	-	-	-
(#367)	S	.36	-	.32	-	-	-	-	-	-
	N	25	0	23	0	0	0	0	0	0
CompScience	$\bar{X}$	3.43	-	3.36	-	3.58	-	-	-	-
(#368)	S	.39	-	.11	-	.21	-	-	-	-
	N	14	0	3	0	6	0	0	0	0
AeroEng.	$\bar{X}$	3.11	-	3.16	-	3.18	-	3.09	-	3.43[2]
(#610)	S	.38	-	.31	-	.22	-	.23	-	.26
	N	22	0	12	0	21	0	23	0	11
ComMgt.	$\bar{X}$	3.21	-	3.37	-	3.39	-	-	-	-
(#620)	S	.40	-	.23	-	.21	-	-	-	-
	N	12	0	16	0	14	0	0	0	0
SysAcqMgt.	$\bar{X}$	3.28	-	3.39	-	3.39	-	-	-	-
(#816)	S	.27	-	.35	-	.28	-	-	-	-
	N	20	0	15	0	17	0	0	0	0
Management	$\bar{X}$	3.37	3.35	-	3.42	-	-	-	-	-
(#817)	S	.43	.37	-	.21	-	-	-	-	-
	N	13	45	0	36	0	0	0	0	0

---

[1] "Cross-sectional" meaning that different individuals are in each of the quarters completed groupings. Data were from officer/students' self-reported TQPR's.

[2] MS holders pursuing an Aero Engineer's Degree.

analyses reported in later parts of this thesis, the grade distribution for each input curriculum group was dichotomized at the median, with the high group being coded "2" and the low group being coded "1."

2. Satisfaction

The officer/student's satisfaction with his area of study was considered as being as important a criterion as TQPR. From the individual officer/student's point of view, satisfaction is of obvious importance. From the U.S. Navy's point of view, satisfaction with an area of study is important because it relates to the officer's desire to use his education in "payback" billets. These billets, called P- and D-coded billets (SECNAVINST1520.4A), are considered by the Navy as requiring an incumbent having graduate education for optimal performance of the tasks in the billet.

The assessment of an officer/student's satisfaction was made by means of the individual's responses to four questions buried within a biographical inventory administered to the officer/students in the sample. These were items 47, 55, 59, and 60 in the biographical inventory. Restatements of these items are given below.

47. Do you wish to serve in a billet requiring the education that you would receive at a graduate school (P-coded billet)?[2]

55. Are you satisfied with your education at the Naval Postgraduate School?

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[2] The wording of this item reflects the fact that in later studies it will be administered to officers before they are selected for a graduate curriculum.

59. Do you now like your degree curriculum?

60. Would you choose a different degree curriculum if you could start over again?

Responses to the four items were either "yes" or "no". "Yes" responses to items 47, 55, and 59 were scored as plus ones, while "no" responses to these items were scored as zeroes. "Yes" responses to item 60 were scored as zeroes, while "no" responses were scored as a plus one. The intercorrelations among the four items and the total satisfaction score were computed and examined. See Table IX.

The patterns of intercorrelations among the four satisfaction items and the total score indicated that a total score could reasonably be generated by summing an individual's 0,1 scores for the four items. This procedure yielded total satisfaction scores of zero through four. The internal consistency reliability of these total satisfaction scores was estimated using a method described in Gulliksen (1950, p. 225). This method, according to Gulliksen, provides the lower-bound estimate of the reliability of the set of total satisfaction scores. These reliabilities are given in Table X, and show that the percentage of error variance ranges from 22 to 35 (Gulliksen, p. 26). As the reliability estimates are lower bound estimates, the sets of total satisfaction scores seem to be reliable enough to justify their use as criteria -- although there is obviously room for improvement. The set of satisfaction items should be increased in number in future research in order to increase the reliabilities of the total satisfaction scores.

Table IX.

Intercorrelations Among the Four Satisfaction Items and Total Satisfaction Scores for Several Curricula

Com Mgt (620), N = 42

		Items			
	Total Sat.	47	55	59	60
Total Satisfaction	X	.63	.69	.89	-.78
Item 47		X	.14	.41	-.45
Item 55			X	.55	-.25
Item 59				X	-.66
Item 60					X
Management (#817), N = 71					
Total Satisfaction	X	.60	.77	.84	-.60
Item 47		X	.31	.29	-.19
Item 55			X	.58	-.14
Item 59				X	-.48
Item 60					X
AeroEng (#610), N = 91					
Total Satisfaction	X		Not Computed		
Item 47		X	.41	.43	-.21
Item 55			X	.62	-.43
Item 59				X	-.67
Item 60					X

Table X.

Estimated Internal Consistency Reliability of the Total Satisfaction Scores for Each of Several Curricula[1]

Curriculum		Reliability	N
ComMgt	(#620)	.73	42
AeroEng	(#610)	.78	61
Management	(#817)	.65	71
OR/SA	(#360)	.77	74

[1] These are lower-bound estimates of the reliabilities.

Table XI displays the frequency distribution of the total satisfaction scores for each of the curricula input groups.

Table XI.

Frequency Distributions of the Total Satisfaction Scores of the Curricular Input Groups (All Data are Cross Sectional)[1]

OpsRes./SysAnal.(Curriculum #360)

Satisfaction Score	Quarter II	Quarter IV	Quarter VI	
4	16	14	21	
3	2	7	4	
2	1	0	1	
1	3	0	2	
0	1	0	2	
Totals	23	21	30	N=74

Comp. Sys. Mgt. (Curriculum #367)

Satisfaction Score	Quarter I	Quarter III	
4	15	7	
3	5	9	
2	1	4	
1	2	2	
0	2	1	
Totals	25	23	N=48

Computer Science (Curriculum #368)

Satisfaction Score	Quarter I	Quarter III	Quarter V	
4	3	2	2	
3	6	1	2	
2	1	0	1	
1	2	0	1	
0	2	0	0	
Totals	14	3	6	N=23

AeroEng. (Curriculum #610)

Satisfaction Score	Qtr. I	Qtr. III	Qtr. V	Qtr. VII	Qtr. IX
4	4	5	9	10	9
3	9	2	5	3	2
2	1	2	3	3	0
1	4	0	1	4	0
0	4	3	2	3	0

AeroEng. (Curriculum #610) continued from Table XI.

Totals	22	12	20	23	11
					N=88

Com. Mgt. (Curriculum #620)

Satisfaction Score	Quarter I	Quarter III	Quarter V	
4	6	8	8	
3	4	5	1	
2	0	1	3	
1	2	0	1	
0	0	2	1	
Totals	12	16	14	N=42

Sys. Acq. Mgt. (Curriculum #816)

Satisfaction Score	Quarter I	Quarter III	Quarter V	
4	10	9	2	
3	4	4	8	
2	2	1	3	
1	2	0	3	
0	2	1	1	
Totals	20	15	17	N=52

Management (Curriculum #817

Satisfaction Score	Quarter I	Quarter II	Quarter IV	
4	9	22	20	
3	1	9	6	
2	0	11	4	
1	3	2	6	
0	0	1	0	
Totals	13	45	36	N=94

The reader is urged to note that the data in Table XI do not represent the results of a longitudinal study of satisfaction. Until longitudinal satisfaction data have been collected, the practical significance of some of the patterns in Table XI cannot be known, as differences between quarter groups in a curriculum could be due to differences among

officer/students and/or "caused" by the ongoing educational experiences of the officer/students.

The frequency distributions of the total satisfaction scores make one point rather clear: the satisfaction scores had a ceiling that was too low. In some curricula, e.g., OR/SA, the preponderance of the total satisfaction scores were fours. If additional items had been included in the set of items addressing satisfaction, a less skewed distribution of total satisfaction scores might have resulted. The practical importance of obtaining a less skewed distribution is multifold, as officer/students who were "really" different in their levels of satisfaction would be less likely to receive the same total satisfaction scores, and as the usual correlational measure, the product-moment correlation, is restricted in magnitude when distributions are non-symmetric (Caroll, p. 349). Future research on the satisfaction of officer/students should utilize a revised total satisfaction scale.

The other preliminary analyses were made using the total satisfaction scores. First, the correlations between the total satisfaction scores and the standardized TQPR's were computed for several of the curricula. These correlations are shown in Table XII. Second, the distributions of total satisfaction scores from the different curricula were compared.

The correlations shown in Table XII vary considerably: from essentially zero in Management to .33 in the OR/SA

Table XII.

Correlations Between Standardized TQPR's
and Total Satisfaction Scores for
Several Curricula

Curriculum		N	Correlation Between TQPR and Satisfaction
ComMgt	(#620)	42	.13
Aero Eng	(#610)	91	.24
Mgt	(#817)	71	.037
OR/SA	(#360)	74	.33

curriculum. Another way to consider these correlations is to say that in Management one cannot predict TQPR from satisfaction, or vice versa, but about 11% (=(.33))^2 x 100) of the variance in TQPR can be predicted (with a linear model) from satisfaction, or vice versa. In sum, the criteria of satisfaction and TQPR appear to be relatively independent of one another.

The total satisfaction score distributions from the seven curricula for which these scores were available were contrasted with one another. Before making these comparisons, the data from the different quarter groups in a curriculum were aggregated. The Kolomogorov-Smirnoff two sample test was used to make the comparisons, rather than using an analysis of variance because of the skewed distributions and unequal sample sizes (Siegel, pp. 127-136). The results of these tests are shown in Table XIII.

Table XIII.

Kolomogorov-Smirnoff Values for Tests of the Differences Between Pairs of Total Satisfaction Score Distributions

	Curriculum						
Curriculum	Aero	CS	ComMgt.	817 Mgt.	CompSysMgt.	SysAcqMgt.	OR/SA
CS	1.05	X					
ComMgt.	1.376	2.877	X				
817 Mgt.	2.617	4.257	0.418	X			
CompSysMgt.	1.006	1.399	0.439	1.029	X		
SysAcqMgt.	0.470	0.637	1.338	2.624	0.249	X	
OR/SA	10.869*	10.134*	2.743	3.726	6.160	3.957	X

---

*Significant at $\leq$ .01 level.

As shown in Table XIII, only two of the 21 K-S tests were statistically significant at the .01 level. (Because of the number of comparisons, the relatively conservative .01 level was chosen.) Both of these statistically significant comparisons involved the OR/SA curriculum--with the other curricula being Aero. Eng. and Computer Science. An inspection of the cumulative frequency distributions showed that the OR/SA distribution contained a greater proportion of scores equal to four (the highest satisfaction score possible) than did the other two distributions.

Prior to using the set of satisfaction scores from a curriculum as a criterion to be predicted using the SVIB, the total satisfaction scores from each curriculum input group were dichotomized. Although it was desired to split each group at the median of its total satisfaction score distribution, it was not possible to do so in many cases due to the skewness of those distributions. When it was not possible to split the distribution at the median, the split was made between satisfaction scores, but as near the median as possible. Table XIV documents the way the various total satisfaction score distributions were split. (Table XI contains the original distributions.)

The dichotomized total satisfaction scores were then recoded "1" or "2" for the low and high groups, respectively. These recoded scores were used as criterion data in some of the analyses using the SVIB as a predictor of satisfaction.

Table XIV.

High-Low Total Satisfaction Group Sizes for Seven Curricula - Data in Table are Numbers of Officer/Students

Aero. Eng.	Qtr. I	Qtr. III	Qtr. V	Qtr. VII	Qtr. IX
Hi	13	7	9	13	9
Low	9	5	11	10	2

Computer Science	Qtr. I	Qtr. III	Qtr. V
Hi	9	2	2
Low	5	1	4

Management	Qtrs. I	Qtr. II	Qtr. IV
Hi	9	22	20
Low	4	23	16

Comp. Sys. Management	Qtr. I	Qtr. III
Hi	15	16
Low	10	7

Communications Management	Qtr. I	Qrt. III	Qtr. V
Hi	6	8	8
Low	6	8	6

Sys. Acq. Mgt.	Qtr. I	Qtr. III	Qtr. V
Hi	10	9	10
Low	10	6	7

Ops. Res./Sys. Anal.	Qtr. II	Qtr. IV	Qtr. VI
Hi	16	14	21
Low	7	7	9

B. ANALYSES USING SVIB OCCUPATIONAL SCALE SCORES TO PREDICT TQPR AND SATISFACTION

Stepwise multiple regression procedures were used in an effort to predict TQPR from scores on the SVIB occupational scales. The Statistical Package for the Scoial Sciences (SPSS) (Nie, *et. al.*) multiple regression program was used for these analyses.

1. Dichotomized TQPR as a Criterion

Multiple regression equations were formed separately for the Management, CS/Aero, and OR/SA developmental groups (see Table III for the sample sizes) using the SPSS stepwise multiple regression program. These runs can be summarized rather tersely: all of the multiple correlations looked promising in the developmental samples, but collapsed in the crossvalidation runs. The crossvalidations, which allow an estimate of the mean square error of a sample regression equation in the population (Darlington, p. 174), indicated that the equations would not be useful for BuPers when making predictions of TQPR.

2. Standardized TQPR as a Criterion

As was described earlier in this thesis (see page 25), the distribution of TQPR's for the officer/students in each curriculum and quarter group was standardized to a mean of zero and standard deviation of one. These standardized distributions were then combined for the developmental groups described in Table III, and the combined standardized TQPR

distributions used as criterion information in multiple regression analyses with the SVIB occupational scale scores as predictors.

3. Computer Science and Aero Eng

Earlier in this thesis, it was mentioned that the data from the CS and Aero curricula had been aggregated because of the high intercorrelation between their mean occupational score SVIB profile. Hence, one of the multiple regression runs investigated whether or not the standardized TQPR's in this aggregated sample could be predicted using the SVIB occupational scales. The standardized TQPR's could not be predicted, as the crossvalidation collapsed (the multiple R in the crossvalidation group was near zero).

In another attempt to develop an equation useful in predicting standardized TQPR's, the data from CS students were removed and a multiple regression analysis made using only data from the Aero Eng officer/students.

4. Aero Eng

Stepwise multiple regression was used to locate and weight SVIB occupational scales predictive of Aero Eng TQPR, and the resulting equation was then crossvalidated. This analysis yielded a very simple model which held up fairly well under crossvalidation. Table XV shows the relevant data.

The crossvalidated correlation of .26 in Table XV would be significant at a type I error level of .087. The correlation is hardly huge, but it could prove useful to

Table XV.

Prediction of Aero Eng TQPR
from SVIB Occupational
Scale Scores

SVIB PREDICTOR SCALE	DEVELOPMENTAL R	DEVELOPMENTAL N	X-VAL R	B	CONSTANT	X-VAL N
Forest Service	.40	89	.26	-.048	1.333	29

BuPers. Figures 1 and 2 are expectancy charts, which are helpful in understanding the usefulness of this correlation (Lawshe, *et. al.*).

Individual expectancy charts are particularly helpful for the individual officer considering whether or not to attend a curriculum such as Aero Eng, because he can be provided an estimate of his probability of attaining an above average TQPR in that curriculum. The institution, say the Bureau of Personnel, can better use Figure 2, as it shows the percentage of officers who can be expected to attain grades above the median grade if they choose the top "X%" of the officers according to the predictor scores.

In one sense, it is obviously impossible to select officer/students such that more than 50% of them will receive grades above the median, because the median is the point above, and below, which 50% of the scores fall. It is possible, however, to select officer/students who will perform

above the median grade in the current sample (a grade of about 3.16). An assumption being made here is that professors have some absolute standards in mind, and do not merely grade students relative to one another. Unless this assumption is true, the officer/students will all have to be equally excellent students so that the professors cannot grade them using the "curve", or the officer/students will find the curve has simply moved upward and the median grade will still be far less than an "A".

Figures 3 and 4 are the expectancy charts for predicting Aero Eng TQPR in a form more useful for BuPers. The predicted TQPR's utilized in Figures 3 and 4 are computed from the equation given in Table XVI and mapped on the "raw" TQPR scale.[3]

5. Management Curricula

The stepwise multiple regression procedure was used to attempt to develop an equation using SVIB occupational scales as predictors of standardized TQPR. An equation using three SVIB occupational scales yielded a crossvalidated R of .23, which, with a sample size of 50, is significant at the .021 level. (The reader should refer to Table III for the curricula represented in this part of the analysis.)

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[3] Predicted TQPR's were computed using the mean and standard deviation of the QPRs predicted along with the mean and standard deviation of the "raw" TQPR's for the cross-validation sample (See McNemar, p. 38).

Table XVI.

Prediction of Management Curricula Standardized TQPR from SVIB Occupational Scales

SVIB Scale	Weight (B)	Constant	X Val R	X Val N
Artist	-.022	.360	.26	60
Air Force Officer	-.036			
Computer Programmer	.047			

Figures 5 and 6 are expectancy charts helpful in using the obtained relationship in predicting Management TQPR's.[4]

6. Ops Res/Sys Analysis Curriculum

Using three of the SVIB occupational scales, a cross-validation multiple R of .39 was obtained. Table XVII contains the data for this equation.

Figures 7 and 8 are expectancy tables which can be used in predicting TQPR's in the OR/SA curriculum.[5]

a. Satisfaction As a Criterion

All of the stepwise multiple regression analyses that were run, with satisfaction as a criterion and SVIB occupational scale scores as predictors, failed to hold-up under crossvalidation.

---

[4] To compute predicted "raw" TQPR's, the following equation was used (McNemar, p. 38):

TQPR Pred. = 1.0762(.360-.038 x Air Force Score -.022 x Artist + .047 x Computer Programmer) + 3.143.

[5] The following equation was used to compute predicted raw TQPR's: TQPR Pred. = .4509(-2.870 + .052 x Psych. - .014 x YMCA + .051 x CPA) + 3.3248.

Table XVII.

Prediction of OR/SA Standardized
TQPR from SVIB Occupational
Scales

SVIB Scale	Weight (B)	Constant	X Val R	X Val N
Psychologist	.052	-2.870	.39	21
YMCA Secretary	-.014			
Senior CPA	.051			

The prediction of satisfaction will therefore have to be done in some other way, perhaps beginning with an expanded number of satisfaction-related questions in the biographical questionnaire (see pages 27 and 28).

FIGURE 1.

Aero Eng Individual Expectancy Chart for Predicting TQPR Using SVIB as the Predictor

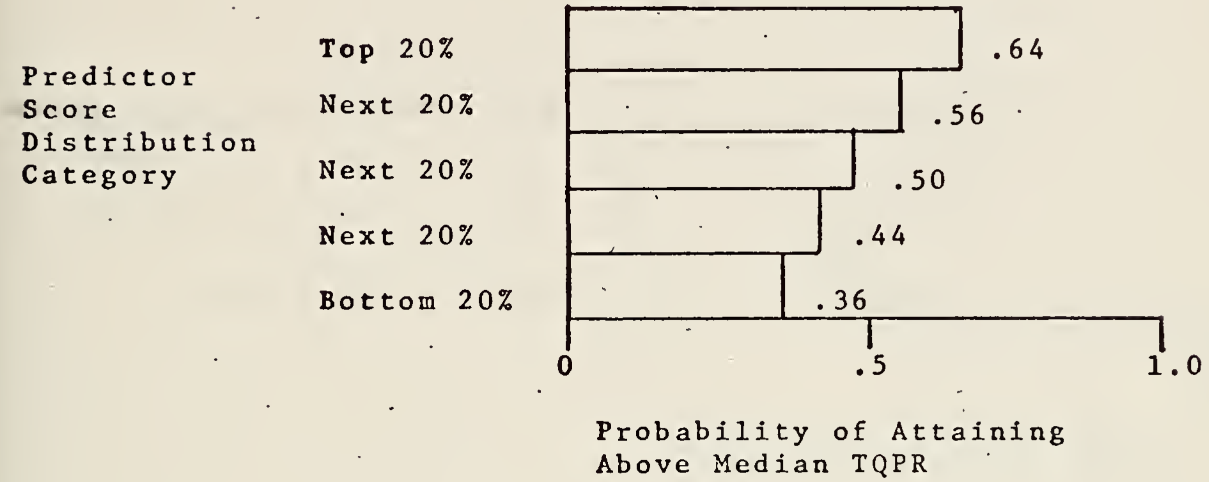


Figure 2.

Aero Eng Institutional Expectancy Chart for Predicting TQPR

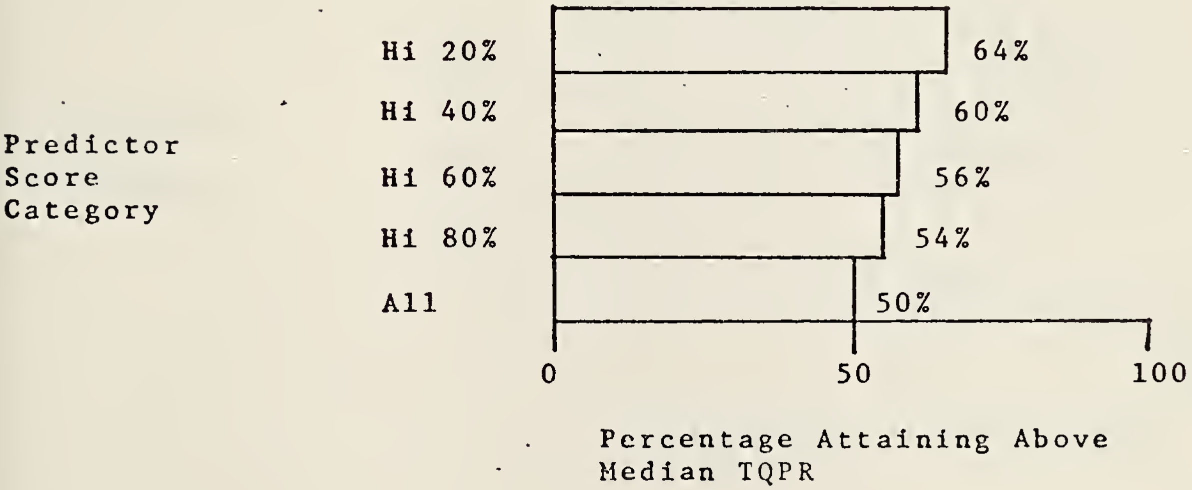


Figure 3.

Aero Eng Individual Expectancy Chart:
Predicted TQPR vs. Probability of Attaining
An Above Median TQPR

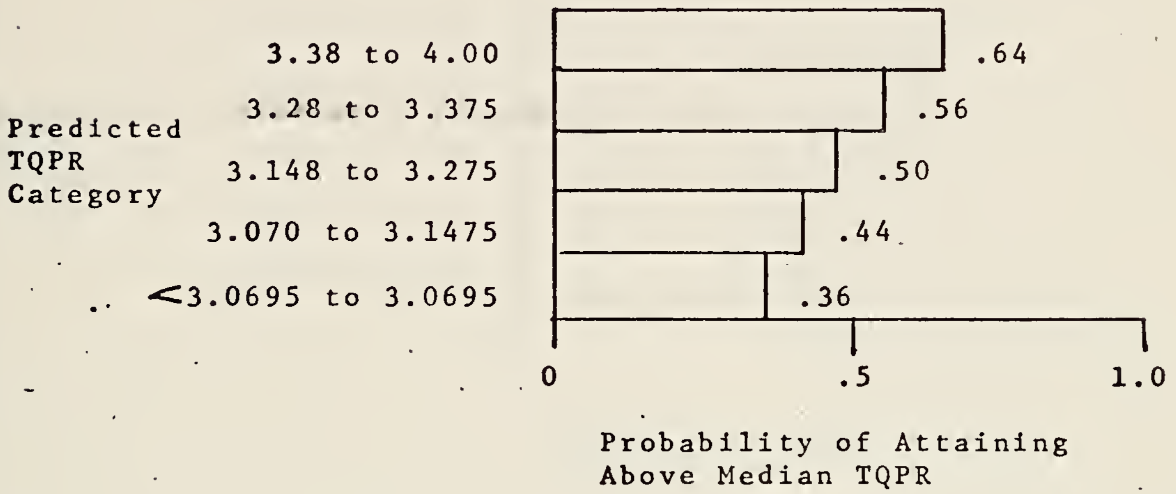


Figure 4.

Aero Eng Institutional Expectancy Chart:
Predicted TQPR vs. Percentage Attaining An Above
Median TQPR

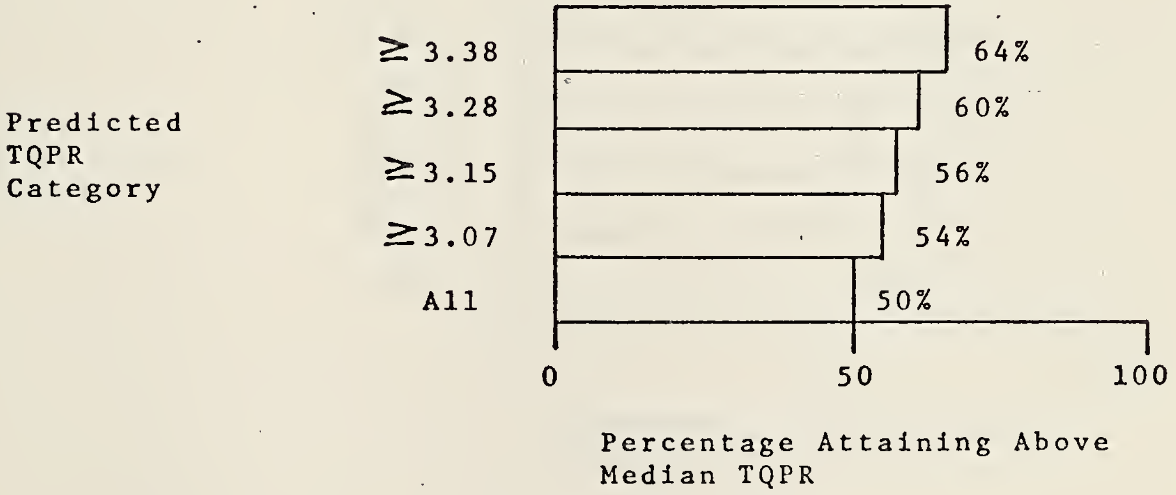


Figure 5.

Management Curricula Individual Expectancy Chart: Predicted TQPR vs. Probability of Attaining An Above Median TQPR

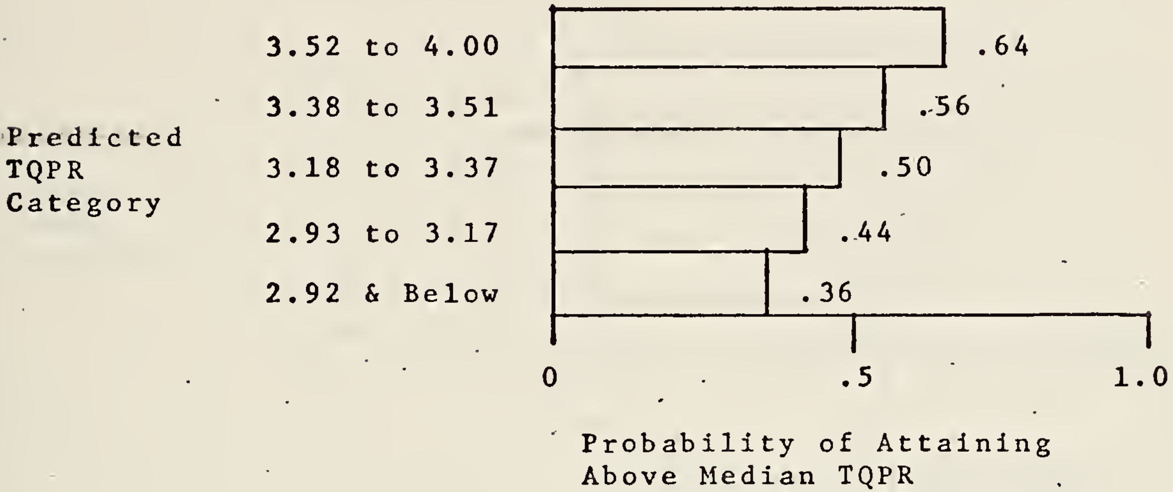


Figure 6.

Management Curricula Institutional Expectancy Chart: Predicted TQPR vs. Percentage Attaining An Above Median TQPR

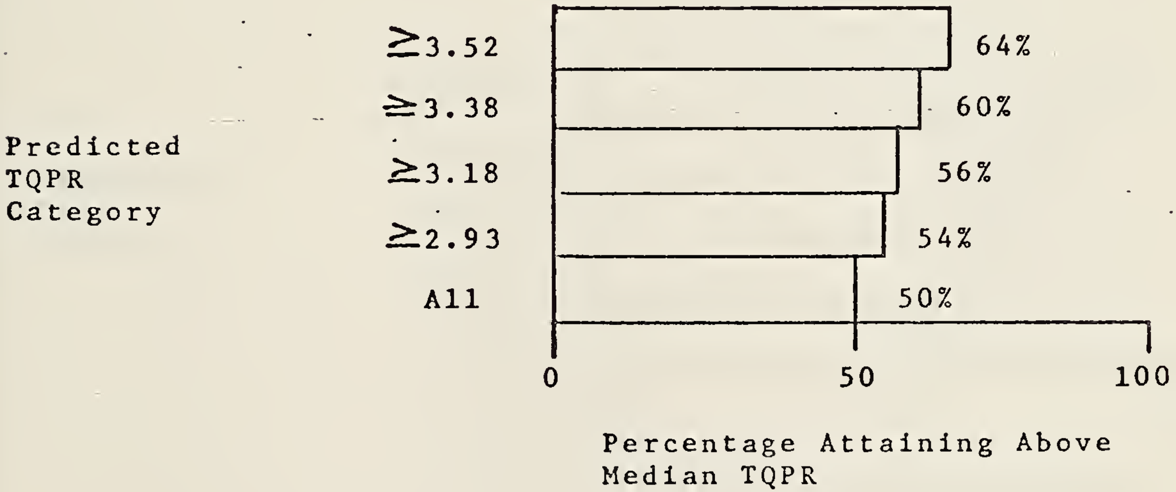
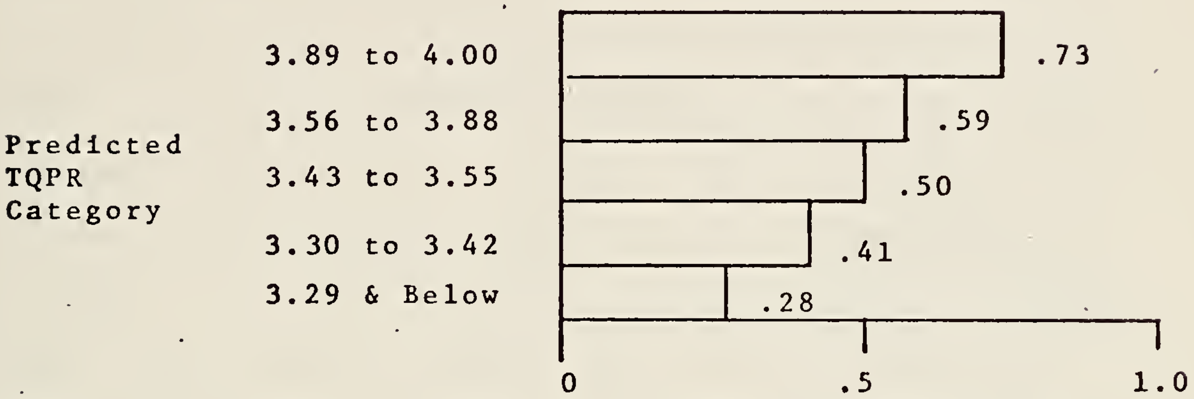


Figure 7.

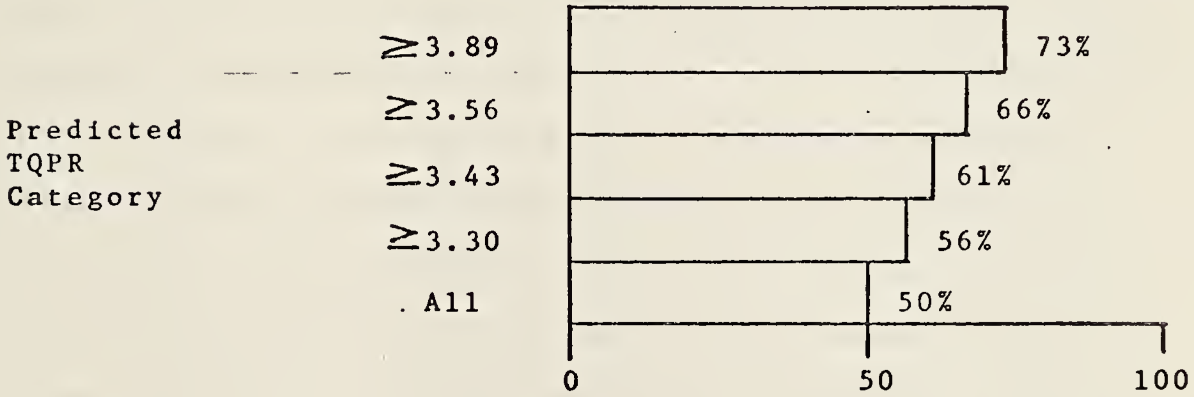
OR/SA Individual Expectancy Chart:
Predicted TQPR vs. Probability of Attaining
An Above Median TQPR



Probability of Attaining
Above Median TQPR

Figure 8.

OR/SA Institutional Expectancy Chart:
Predicted TQPR vs. Percentage Attaining An Above
Median TQPR



Percentage Attaining Above
Median TQPR

V. CONCLUSIONS

With the high cost of advanced education, both in terms of dollars and time away from operational units, it is vitally important that the resources of all descriptions available for this education be used as efficiently as possible. One way to improve efficiency is to do the best job possible of choosing the students. The investigation reported in the preceeding pages concerns improving that efficiency. It is centered on the Strong Vocational Interest Blank (SVIB) which has shown some promise in predicting academic success in various circumstances and has been used by the Navy in several other applications. The Personnel Research and Development Center (NPRDC) in San Diego is well-acquainted with the SVIB and can easily handle scoring of the tests on either an occupational scale basis or an item response basis.

The analysis reported in this paper, indicated some very useful relationships between SVIB occupational scales and academic performance as indicated by TQPR. A predicted TQPR can be computed for a man applying to a given curriculum using a simple equation including several scale scores as the factors with appropriate weightings. It was found that several curricula could be merged to yield larger sample sizes because of the high correlations among their scale scores. This was possible with the regular management, CSM, SAM, and communications management groups. CS and Aero were

merged, also. Several regression runs were made with OR/SA merged with management curricula, but results were not nearly as good as when the groups were used separately.

An important aspect of the life of a modern naval officer is his satisfaction with his duties and chosen specialty. Therefore, it is desirable to predict an officer's satisfaction with a curriculum and future P- or D- coded billets; this enhances career planning for the officer and supports the organizational development of the Navy. Unfortunately, this investigation into prediction of satisfaction has failed to reveal a useful prediction method using the SVIB occupational scales.

APPENDIX A

Standard Means and Standard Standard Deviations for Various Curricula and SVIB Occupational Scales

Scale	Mgt		CS		CSM		SAM		COMMGT		Aero		OR/SA	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Naval Officer Scale	46	12.0	49	11.7	49	10.1	49	10.4	47	11.7	47	9.3	50	10.3
Physical Therapist	36	11.9	41	10.9	35	12.6	34	10.2	32	10.5	37	10.2	36	12.0
Dentist	21	10.1	30	9.1	21	9.7	24	9.2	27	9.8	28	9.1	22	10.7
Osteopath	26	9.3	31	7.4	26	9.7	29	9.4	27	9.8	30	8.7	26	11.5
Veterinarian	27	8.8	29	7.0	26	9.0	28	8.2	29	10.1	28	7.3	23	9.8
Physician	25	10.6	36	7.7	26	10.9	27	12.5	28	11.1	32	10.6	26	11.5
Psychiatrist	21	11.1	26	9.8	21	9.3	22	12.9	18	9.3	25	11.9	24	11.2
Psychologist	22	9.1	29	9.2	24	8.5	26	10.8	23	9.7	27	10.1	28	9.5
Biologist	21	11.7	34	9.7	25	11.1	25	12.7	25	13.4	30	12.2	26	12.3
Architect	24	11.6	30	9.7	25	10.9	26	10.5	29	10.5	30	11.7	25	10.5
Mathematician	14	10.2	24	10.5	18	9.6	17	11.0	21	11.8	22	11.1	20	11.4
Physicist	15	12.3	28	10.6	20	12.0	21	12.3	22	13.6	25	12.7	21	12.8
Chemist	22	13.6	40	8.9	28	13.6	29	13.1	30	13.2	35	13.1	31	14.1
Engineer	14	12.1	33	8.8	27	12.4	30	10.6	32	12.3	33	12.2	28	11.3
Production Manager	39	9.7	38	10.3	39	8.0	41	9.5	39	9.6	39	8.7	39	8.9
Army Officer	41	12.9	48	11.4	43	9.9	42	9.9	42	13.2	42	8.9	42	11.1
Air Force Officer	38	11.3	45	10.3	41	10.6	41	8.8	39	9.1	43	8.2	41	9.4
Forest Service	27	11.8	27	9.0	27	11.6	29	10.9	30	11.4	29	9.6	23	13.4
Farmer	33	10.7	35	7.3	33	10.2	35	8.7	36	8.4	36	8.3	30	11.1
Math-Science Teacher	27	11.2	38	10.6	28	12.9	39	8.8	29	7.7	32	8.2	31	9.7
Printer	26	9.8	29	10.8	26	7.2	28	9.0	30	9.7	28	8.6	26	8.8
Policeman	23	8.9	24	9.5	23	6.8	22	7.5	26	8.1	23	7.6	22	7.7
Personnel Director	32	12.6	22	12.0	30	11.7	29	10.3	27	11.4	25	11.3	31	13.6
Public Administrator	42	12.1	34	10.7	42	10.1	40	10.3	37	10.4	37	10.2	41	11.7
Rehabilitation Couns.	32	11.4	27	8.0	39	11.3	30	9.4	27	8.9	28	9.9	32	11.4
YMCA Secretary	34	13.2	27	11.3	31	12.3	28	12.1	25	11.9	27	13.0	31	12.8

APPENDIX A continued

Scale	Mgt		CS		CSM		SAM		COMMGT		Aero		OR/SA	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Recreation Admin.	37	12.8	30	9.8	33	12.8	31	11.3	28	12.4	30	13.6	34	12.6
Social Worker	30	13.2	23	9.2	28	13.3	26	11.7	22	10.5	24	12.3	29	12.6
Social Science Teacher	31	11.1	20	7.8	27	12.5	26	10.8	26	11.1	22	11.3	26	10.8
Librarian	25	9.9	23	8.0	24	9.9	24	10.7	24	9.7	23	8.1	26	10.3
Artist	23	9.2	28	10.2	24	8.0	24	8.1	25	8.8	27	9.3	23	8.4
Music Performer	29	9.8	32	8.5	27	8.7	27	9.5	26	9.5	31	8.2	29	8.6
Music Teacher	26	11.0	21	8.0	22	9.9	22	8.9	21	9.7	22	8.9	24	10.4
CPA Owner	23	10.0	22	6.4	27	8.4	24	10.7	27	11.5	21	8.3	28	11.1
Senior CPA	29	12.5	32	10.0	34	9.4	33	10.8	37	12.0	31	10.0	36	10.2
Accountant	28	12.6	24	10.5	28	9.4	29	11.5	30	11.7	25	9.0	31	10.5
Office Worker	30	11.1	24	9.4	29	9.7	29	11.9	30	10.2	24	9.4	30	10.6
Credit Manager	37	12.6	28	12.2	34	11.9	33	11.4	30	10.6	29	12.1	35	12.7
Chamber of Commerce	40	11.2	30	8.1	36	10.7	35	9.7	33	9.7	31	9.1	37	11.2
Bus. Educ. Teacher	36	11.9	27	8.6	34	11.0	33	10.4	30	10.5	28	11.0	32	10.7
Purchasing Agent	35	10.0	31	9.6	35	9.1	36	11.1	36	9.1	32	10.1	33	8.7
Banker	27	9.5	19	6.7	27	8.8	27	10.4	29	7.9	23	8.7	24	8.4
Pharmacist	26	8.8	24	5.7	27	8.7	26	9.7	26	10.2	25	7.8	24	7.8
Mortician	32	8.2	23	7.4	29	8.3	29	8.5	29	9.1	26	7.5	27	7.5
Sales Manager	30	11.1	19	8.8	28	10.2	28	10.8	28	9.7	22	9.6	26	10.5
Real Estate Salesman	36	8.6	28	7.7	35	8.4	34	8.1	35	9.1	31	7.8	32	8.1
Life Insurance Sales	29	10.2	18	7.7	26	9.8	24	9.0	24	11.4	21	8.3	24	9.7
Advertising Man	28	9.7	21	8.3	27	10.9	25	6.8	27	8.5	24	7.7	26	9.8
Attorney	27	9.0	25	6.7	29	8.8	27	7.7	29	8.1	26	8.1	28	8.4
Author-Journalist	28	8.3	26	8.3	28	8.7	27	6.6	29	8.0	28	8.0	28	7.6
Pres. - Mfg. Concern	25	10.2	16	9.5	26	9.0	26	9.2	24	9.3	21	9.0	23	8.6
Computer Programmer	33	12.4	49	10.5	40	13.8	39	11.3	37	12.6	43	10.3	43	11.2
Interpreter	28	10.9	24	7.6	24	11.8	27	10.8	24	10.1	25	9.6	29	10.7
Carpenter	23	13.2	29	9.6	23	12.3	27	11.4	29	10.3	30	10.9	22	12.9
School Superintendent	23	12.1	14	10.8	22	11.6	20	8.7	19	9.9	16	11.1	21	10.6

APPENDIX A continued

Scale	Mgt		CS		CSM		SAM		COMMGT		Aero		OR/SA	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
A-B	44	12.3	42	7.0	44	13.3	40	11.1	39	10.6	42	10.8	45	13.0
ACH	42	10.3	49	9.9	45	9.4	43	10.8	45	9.4	46	10.5	49	10.0
L-C	42	9.9	41	7.7	43	9.4	42	9.2	42	9.3	41	8.1	44	8.7
M-F	50	9.1	55	6.4	52	9.1	55	7.9	58	8.5	55	7.1	51	8.7
OCL	60	7.8	55	7.3	61	6.2	58	7.1	58	7.1	57	6.7	61	6.9
SIN	44	12.1	50	11.2	46	12.1	50	10.7	52	10.3	49	11.4	45	11.2
SPL	42	8.1	42	7.4	41	9.6	41	7.9	39	9.7	41	8.6	43	9.3
N-6	52	9.3	56	7.0	52	9.2	53	8.2	55	9.2	55	9.5	51	11.4
MGE	52	11.3	49	9.7	51	10.4	51	10.7	48	10.6	49	10.5	52	9.2

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